DOCUMENT RESUME

ED 397 823 IR 018 011

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TITLE Technology Resource Teachers: Is This a New Role for Instructional Technologists?
PUB DATE 96
NOTE 33p.; In: Proceedings of Selected Research and Development Presentations at the 1996 National Convention of the Association for Educational Communications and Technology (18th, Indianapolis, IN, 1996); see IR 017 960.
PUB TYPE Reports - Research/Technical (143) -- Speeches/Conference Papers (150) -- Tests/Evaluation Instruments (160)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS Appropriate Technology; Computer Attitudes; Computer Literacy; *Computer Uses in Education; Educational Planning; *Instructional Design; Instructional Innovation; Intermediate Grades; *Job Analysis; Job Skills; Junior High Schools; Middle Schools; Public School Teachers; Students; Surveys; Tables (Data); Teacher Education; Teacher Educators; *Teacher Role; Teaching Methods
IDENTIFIERS Competency Needs; *Instructional Support Services; *North Carolina; Technology Integration

ABSTRACT

Public schools have created the position of the Technology Resource Teacher (TRT) in an attempt to establish a technical and instructional support system at the school level to assure the proper usage of technology (particularly computers) by both teachers and students. This study explores the roles and responsibilities of the Technology Resource Teacher (TRT), and the effects of the TRT's role on the integration of technology in the classroom. The study also examines how the TRT's role differs from that of instructional designers/technologists in the same position. The study was conducted at six middle schools in a school district in southeastern North Carolina, with data collected through interviews, classroom, workshops, and site observations, records, reports, documents, questionnaires, attitude surveys, and focus group discussions. Results showed that the role and responsibilities of TRTs are primarily instructional, although technical and administrative responsibilities are also expected. Excellent communication skills, the ability to understand the dynamics of teaching and the role of teachers, being able to work closely with classroom teachers, and familiarity with the school context all contribute to the success of the TRT. TRTs' instructional strategies varied, however; they did not conduct needs analyses, did not prioritize needs, did not have specific objectives, nor did they have a planned action for implementation and evaluation. Had the TRTs been trained in the field of instructional design, they would have combined their experience in the school environment with an analytical, systematic, and evaluative approach. Suggestions for improvement include: (1) recruit educators to become potential instructional designers in the public schools; (2) include a public school internship component to instructional technology programs; (3) provide inservice instructional technology training for public school teachers; and (4) target potential employment opportunities such as Technology Coordinator, Technology Resource Teacher, and other public school technology positions. A copy of the computer survey is appended. (Contains 18 references and 22 tables.) (Author/SWC)

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ED 397 823

Title:

Technology Resource Teachers: Is This a New Role for Instructional Technologists?

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Introduction

For decades, skills in instructional design and technology have not been tapped by public schools. One resource that has been consistently overlooked in public school systems is the pool of educators who have been trained in instructional design and technology. Even in the educational technology field, little attention is given to the role that instructional designers/technologists can play in solving the problems facing the schools, including integration of technology into classroom practices. Instead, the emphasis has been on increasing the extent to which computers are used for instructional purposes. It is optimistic to assume that the increased use of computers in schools will necessarily result in properly integrating technology into instruction to improve students' learning outcomes. Professionals in the field agree that the value of learning technology is actually dependent upon what use we make of them.

Leaders in the field of instructional technology seem to loose hope of getting instructional designers/technologists into school systems in order to help teachers to properly design their curriculum while integrating new technology (Reiser, 1988). Hence, most professionals in the field focus their attention on business and industry. Others have tried to influence classroom instruction by developing instructionally designed software for classroom instruction and/or developing automated instructional design software for teachers (Merrill & Li, 1988, 1989). Still others place greater emphasis on preservice teacher education programs to prepare teachers to learn not only how to use technology, but also how to integrate it into their instruction (e.g., Dick & Reiser, 1989; Reiser, 1988; Reiser & Dick, 1996; Rosset & Garbosky, 1987; Sullivan & Higgins, 1983; Zellner & Rieber, 1991). There has also been strong support for school restructuring initiatives among leaders of the field. Proponents of systemic change in education believe that the existing system is outdated and is no longer serving the needs of learners (Mory & Salisbury, 1992; Reigeluth, 1992; Salisbury, 1993). Therefore, they suggest to replace the existing system with one which is more appropriate to the needs of students in the twenty-first century.

While educational technologists are trying to find ways of becoming more involved in solving educational problems, school systems, under pressure for reform and accountability, have begun to use their technological resources to ensure increased academic outcomes of today's diverse student population. Lamenting that previous educational media such as language arts labs, closed circuit television, and movie projectors yielded less than the anticipated results in public schools and that microcomputers are almost meeting a similar fate, it seems that school systems are beginning to realize that the problem is more instructional rather than technological. Emphasis of many school reform initiative plans for the integration of computers into classrooms across the curriculum (e.g., Levy, 1986; Mergendoller & Pardo, 1991; Sanacore & Alio, 1989) is one example of these efforts. Another example is public schools' attempt to establish a technical and instructional support system at the school level to assure the proper usage of the technology, mainly computers. This attempt resulted in the creation of a professional job position that seems to go beyond utilization of media and library resources. The fact that a technology coordinator or the Technology Resource Teacher is assigned to this position in several states, districts, and/or counties demonstrates public schools' desire to focus on integration of technology into classroom instruction. But, how successful they are and whether or not they are achieving what they desire to achieve has not been studied.

It appears that the instructional designers' expertise is needed more now in the public schools than any time before. It is obvious that if schools are to look beyond the number of computers and their usage, an instructional support system is needed to help teachers design their instruction in a way that new technology is an integral part of it. The questions are raised: Do the school systems consider or mention instructional designers/technologists as a solution to their problems? Will they ask for the instructional designers/technologists' help in the future? Experience shows that the answer to this question is "No". However, very few researchers have tried to empirically find those conditions under which instructional designers or technologists may be best involved in the integration of technology into classroom practices. It is not hard to anticipate that, given emerging technologies and the increasing demands and needs for integration of these technologies to the classrooms, the field of instructional technology can provide the best instructional support for teachers and the means by which to keep them updated.

The Purpose of the Study

In an attempt to respond to school reform initiatives and a State-mandated use of computers in the public school classroom, one school district located in southeastern North Carolina began to implement a computer competency program in the local elementary, middle, and high schools beginning in September, 1994. This program was to be integrated into the classroom curriculum in such a way that the focus was not merely on the operational use of technology, but on the use of technology as a tool to facilitate students' learning by using technology to generate ideas and access information. To reach this goal, the teachers are expected to design and implement instruction in a way that technology is a part of their classroom practice. Thus, teachers need not only to have skills in operating and using technology, but also to have skills in designing, developing, implementing and evaluating curriculum and instruction which integrate different technologies and delivery systems.

Most teachers in the county do not possess skills to use technology in their classrooms, nor do they know how to integrate the technology into their instructional practices. To begin this educational process, the school district has recently hired thirteen Technology Resource Teachers to support and facilitate integration of technology into classroom teachers' instructional practices. Some of the resource teachers have been in their schools for several years, and were reappointed within their school to be full-time technology educators.

The purpose of this study was to explore the roles and responsibilities of these Technology Resource Teachers ("TRT") and the effects that their roles have on the integration of technology in classroom instruction. The study also sought to examine: (i) how Technology Resource Teachers' roles differ from those of instructional designers and technologists if they were to be involved in public schools, and (ii) what an instructional technologist might do if he or she was assigned to this position. The study, therefore, focused on the following specific questions:

- What are the roles and responsibilities of these educators?
- What role and expectations does the district have for these educators and how are these roles and expectations being fulfilled?
- Do the resource teachers possess the skills and knowledge required to successfully play their role? If so, how did they acquire those skills and knowledge?
- How do the TRTs affect integration of technology into classroom practice?
- What kind of skills and knowledge does a teacher have to possess to be eligible for being a TRT?
- What are the differences and similarities between the TRT and an instructional designer/technologist?
- Would the role of the TRT propose a new set of competencies for instructional designers/ technologists who want to serve the school system?
- How are these competencies different from those of a media specialist?

The Research Method and Its Framework

A naturalistic and participant-oriented model within the paradigm of naturalistic studies was used for conducting this exploratory study. This approach was perceived to be appropriate because it could help researchers describe the program holistically and understand it from the perspective of participants. It also provided enough flexibility to base information on program activities rather than on program intent. It also made it possible to employ multiple data-gathering methods, especially observation and interviews. Rippey (1973) suggests this approach for understanding the process of change in various types of organizations.

The following data-collection methods were used in this study:

- informal and formal interviews,
- classroom, workshop, and site observations,
- public and personal records, reports and documents,
- questionnaire and attitude surveys, and
- focus group discussion.

Due to the limitation of time and resources and because the program was first conducted at the middle school level, the present study focused only on middle schools in the county (six in total). The data collection began in early January, 1995 and continued until early December, 1995. From January to March, 1995 the study focused on gathering preliminary data about the program, conducting interviews with the Technology Coordinators for the county, reviewing documentation on the roles and responsibilities of the TRTs, as well as documentation on the whole program, and visiting each of the sites.

From March to May, 1995, interviews were conducted with the TRTs, their classroom and training workshops were observed, and attitude and general information surveys were administered to teachers on each of the sites being observed. The general survey was constructed by the researchers around the major questions of the study. A Computer Literacy Attitude Survey ("CLA") was also adopted and completed by the teachers at each site. (Both of these surveys may be viewed in Appendix A.) Both survey instruments were completed by teachers following one of the school's professional development meetings upon the request of the respective Technology Resource Teacher.

The General Information Questionnaire consisted of 18 closed-ended and nine open-ended items. The closed-ended items asked about teachers' computer facilities at home and the classroom, their usage of their computer facilities, their previous and present computer training, the computer competency tests, and their feelings about their computer skills. The open-ended items, on the other hand, asked teachers about their perception of the role and responsibilities of the TRTs, and the nature of the help that teachers receive from the TRT in their respective school. The CLA survey consisted of 50 Likert-scale type items which were developed and used by Savenye and her colleagues (Savenye, 1992; Savenye, Davidson, & Orr, 1992) to measure attitudes of preservice teachers toward computers. The items were slightly modified to be used with in-service teachers. In addition to the Likert-scale items, teachers were asked several questions about their background and the number of hours that they had participated in computer training workshops. The return rate for both the general survey and the CLA survey was between 90-95% for two of the schools and was between 55-71% for the other four schools.

During the 1995 fall semester, interviews were also conducted with the principals of the schools, and a focus group discussion was conducted with the technology coordinators of the county. All of the interviews and focus group discussions were audio-taped and transcribed for further analysis. Field notes were used for recording observation data and informal interviews.

Data Analysis

Data were analyzed using both qualitative and quantitative analysis techniques. Interview and observation data, the results of the open-ended questions from the general survey, and the collected documents were analyzed qualitatively using the Miles and Huberman (1984) model. Based on this approach, the first part of the analysis was data reduction. During this process, the data chunks were identified and coded, the patterns that best summarized a number of chunks were sorted and then were further subsumed into larger patterns. In some cases, the data were organized using the frequency of the responses to specific questions or by the pattern of responses. In such cases, however, the numbers were used together with the words to keep the data in its context. During the second analytical stage, the data were summarized and organized using matrices, charts and tables. This stage helped the researchers interact with the data and draw their preliminary conclusions, which in turn went through another round of testing and verification using all different sources of the data for the final conclusion.

The results from the closed-ended items of the general survey and the attitude questionnaire were analyzed quantitatively. Descriptive statistics, cross tabulation, Pearson correlation, and MANOVA were the quantitative techniques that were used for this part of the data.

Results

Description of the School District and the Technology Initiatives

The study was conducted in all of the middle schools (a total of six) within a city district in the northeastern United States. The district is within a zone that draws from affluent neighborhoods, as well as from neighborhoods of racially- and ethnically-mixed working- and low-class families.

In 1992, the State of North Carolina Department of Public Instruction put together a set of computer skill competencies as a basic requirement of public school students and teachers. In anticipation of this state technology initiative that requires all schools to integrate technology into their classrooms and all teachers and students to pass a technology competency test, the district technology coordinators had to design a plan that would enable the classroom teachers in the district to begin to attain these computer skills. While the elementary schools in the district already had a designated classroom teacher to act as a technology resource person, and the classroom teachers were already using technology in the elementary classrooms to some degree, the middle schools in the district were not set up with such a situation. Since the mandate included a timeline to eventually administer a test to all eighth graders in the state, insuring that students had met the minimum computer skills, it was imperative that the middle school teachers and students be targeted for broader technology support.

The TRT position was created to provide technical and instructional support at the school level to help teachers integrate technology into their curriculum and classroom practices, and to assist teachers in passing the technology competency test required by the state. This position was created to be different from the media specialist position which already existed in most schools. The role of the TRT differs from that of the media specialist because the TRT was expected to be responsible for integration of computer technology into classrooms, while the media specialist was responsible for library media and providing print and media support at the school library. Two technology supervisors at the district level were in charge of developing a job description for the TRT position and helping principals hire the qualified individuals. These two supervisors were also in charge of preparing the TRTs for their job responsibilities by providing them with training workshops and proper technical and administrative support.

The Technology Resource Teachers: Who They Are and What They Do?

Six technology resource teachers were interviewed in this study. Their educational background spans from one year of previous teaching experience to twenty-two years of previous teaching experience. The majority of them have a background in teaching math (83%) and/or science (16.7%). Four of the TRTs were classroom teachers in their respective schools before being appointed to this position. Two of the TRTs were hired from outside the school and were new to the school as well as to the appointed position. In general, the TRTs' background in computer training incorporates college courses and in-service training workshops (50%), job related experiences (33.3%) and self-learning/practices (16.7%). Each of the TRTs have passed the computer competency test required by the state. Their reasons for becoming TRTs include an interest in technology and an interest in teaching. None of the TRTs, however, have had any training or college courses in instructional design and technology. They also have not had any training and/or experiences in analysis, design, development and/or evaluation of instructional materials and/or programs.

The observation, interview and questionnaire data show that all six TRTs have formed the computer lab at their school and have maintained its operation throughout the year. They have used the computer lab to teach technology skills to the teachers and to the students in their schools . The main focus areas in workshops are: database, word processing and spreadsheets. Terms and operation, keyboarding, societal uses, and ethics have also been taught. Teachers at each school then were given the choice of attending the training workshops provided at their site or other schools. Since the response rate was not equal for each school, a random sample of 17 responses was selected from each school for further analysis. A chi-square test of difference between the number of training workshops provided by each school (after equalizing the sample size across the schools) shows that teachers in each school have received equal number of training workshops (see Table 1). This result, combined with the observation and interview data, indicates that all six TRTs provided similar hours of training workshops for teachers in their respective schools.

However, the analysis of data from different sources, including the general survey, suggests that more teachers in School 2 were able to take the computer competency test in all five areas (see Table 1). School 1 rates second with respect to the number of teachers who were able to take competency tests in all areas, except for keyboarding. Data shows that the teachers in School 2 and School 1 do not rate their computer skills significantly higher than the other schools. In some areas, such as word-processing, keyboarding and spreadsheet, School 2 and School 1, in fact, rate their computer skills lower than School 3 (see Table 2). Also, the teachers' previous experiences with computers in School 1 and School 2 are not significantly different from the other schools (see Table 3). In fact, teachers in School 1 ranked second lowest with respect to their previous experience with computers. Analysis of qualitative data provides an explanation for these results. The TRTs in both School 2 and School 1 emphasize their role in helping teachers pass the technology competency test, while the other TRTs do not identify this role as their major responsibility (see Table 4). Teachers' perception of the TRT's role and responsibilities in School 2 and 1 suggest that this emphasis by the TRT in helping teachers pass the technology competency test has obviously been communicated to the classroom teachers, possibly during training workshops and/or during implementation of other teaching strategies.

In addition to providing training workshops, technical support, and troubleshooting, the majority of TRTs attempt to help teachers develop lesson plans that integrate computers into instruction using word processing, spreadsheets, database and other educational software (see Table 5). The TRTs' primary instructional strategy for accomplishing this goal is to model the teaching of the various computer competencies to students through an integrated lesson within different subject areas (e.g., language arts, mathematics, social studies, and science).

> . . . .Well anything like this lesson that I have created. We will actually do this lesson at our workshop. . . .A lot of what I do with the kid I lead the teachers through first. (TRT School 2)

> . . . . When they come to the lab even though it is a generic lesson, it is oriented to some subject. It is database on planets or a spreadsheet on nutrition, so I think they can see that there are ways to do this, but we just have to make it specific to what they are teaching in the classroom. . . . (TRT School 5)

> . . . .If I have to pull them in there, they will use it. You know once they see how it can be done, then they will be more willing to do on a more regular basis. . . .Whenever I come up with something I go to them. . . . (TRT School 1)

The integrated lesson in most cases is taught by the TRT, while the classroom teacher is also present to help or to observe. In a few cases, the teachers themselves teach the integrated lesson while the TRT is present to help.

All TRTs indicated that their immediate goal with respect to their role at the school is to bring technology to teachers and students and to make them feel comfortable with technology.

> . . . .I think my role is to prepare students and teachers for computer usage. (TRT School 2)

> . . . .Well, have a very good impact on teachers' use of computers. (TRT School 6)

> . . . . To set computer lab and be able to provide technical and instructional support. (TRT School 3)

> . . . To be able to provide technical support and comfort teachers to use computer. Also help teachers and students in their computer skills for computer competency test. (TRT School 1)

> . . . Get teachers to come to computer lab and provide technical support. (TRT School 4)

They also infer that their long-term goal is to help teachers integrate technology into their classrooms and for the respective subject teachers to assume the responsibilities of preparing students for computer usage. None of TRTs seem to have specific short-term or long-term performance objectives and/or expectations for teachers and/or students at their respective schools. The mandated state competency exam seems to have driven both their activities and workshops at the schools.

Q: Do you have specific goal or objectives for this year?
My aim is to get a support system in place, and by that I mean my teachers need to have basic skill so that when we bring the students in here, two of us know the skills and could answer the questions. . . I want to get as many of them passing the test and having success with the test. . . .(TRT School 2)

I think getting with the teachers in their planning periods. If I can sit in with them, seeing what they are doing, finding out their problem areas, maybe I can enhance their problem areas of how they teach a lesson. But I think basically working with them. (TRT School 3)

We started off with the operation and care and keyboarding because they are just basic information about the machines. We have now moved into more complicated item types such as database and spreadsheets. In our school we emphasize on computer competencies. . . .
(TRT School 6)

As indicated above, upon establishing the computer labs at their schools, all six TRTs began to provide computer training workshops for teachers. However, interview and observation data show that none of the TRTs attempted to conduct a formal needs assessment to identify the areas of needs for training. While one may assume that technology coordinators at the district level have already identified the needs and the problem areas at each school, the interview data with the coordinators do not provide any evidence for this assumption. The majority of TRTs, however, did indicate that they already knew the areas of needs in their schools due to their familiarity with the school and due to their close relationship with the teachers. Two of the TRTs also indicated that they administered a survey at the beginning of the year to get a sense of the teachers' perceptions about their knowledge and skills in the different computer competency areas.

All TRTs also established an hourly computer lab schedule for their schools. This schedule is used to encourage classroom teachers who want to bring their classes to the computer lab to arrange the time to do so. The TRTs seem to use the computer lab sign-up sheet to identify the teachers who have begun to think about integrating computers in their curriculum. A few of the TRTs also keep a sign-up sheet for the teachers who attend the training workshops in order to monitor the hours of training workshops that each teacher completes. However, none of the TRTs seem to use a formal and continuous monitoring process for identifying the teachers' progress; nor do they use any method for identifying the effectiveness of the strategies that they have employed to encourage teachers to integrate technology into their curriculum. Again, it seems that the number of teachers who are able to pass the computer competency test is an implicit indicator of success for both the TRTs and the technology coordinators at the district level. Nevertheless, all TRTs seem to informally monitor the teachers' integration of computers into their curriculum.

<u>The Role and Responsibilities of Technology Resource Teacher: What are They Expected to Do and How Do They Perceive their Job?</u>

Tables 6a and 6b summarize the data from different sources regarding the roles and responsibilities of the TRTs. As Table 6a indicates, the job description of the TRT describes the instructional, technical and administrative dimensions of the job. A content analysis of the job description also reveals that the instructional aspect of the position is emphasized more than the other two aspects of technical responsibilities and administrative responsibilities (8 statements on instructional responsibilities as opposed to 4 statements on technical responsibilities and 5 statements on administrative responsibilities). The list of job qualifications also requires TRTs to have a minimum of three years teaching experience. Thereby, indicating the pedagogical importance of the position.

Table 6a also summarizes the perspectives of the middle school principals and the district technology coordinators about the roles and responsibilities of TRTs. While the job description and qualifications for TRTs emphasize the instructional importance of the position, both the principals and the technology coordinators indicated the technical and interpersonal skills of TRTs to be the major factors for the selection of the individuals for this position. The majority of the principals, however, point out that they preferred to select one of their technically qualified teachers at the school for the position, if one existed, instead of hiring someone from outside of the school. Their reasons for this preference include the easier transition process and the familiarity of the TRT with the school's staff and its context.

TRTs were also asked to describe their perceptions of their roles and responsibilities. Table 6b summarizes the statements that are used by each TRT to describe their job. As Table 6b suggests, while there are some differences in the perceptions of each TRT of their roles and responsibilities, the majority of TRTs (83%) agree on the fact that they spend 70% or more of their time providing technical assistance and support (e.g., setting and maintaining the lab, troubleshooting, installing software and hardware) and only 30% or less of their time providing instructional support. This is why they believe that they should have spent the majority of their time providing instructional support. Table 6 also lists the common statements that teachers at different schools use to describe their perceptions of the role and responsibilities of the TRT. Although there are some differences in the perception of teachers in different schools (see Table 4), it seems that teachers generally perceive the TRT as providing more instructional support than technical support. There are also commonalities between the TRTs' perceptions of their own roles and responsibilities and the teachers' perception of the TRTs' roles and responsibilities. For example, the TRT in School 3 perceives self as a technical support. This perception is consistent with the perception of the classroom teachers in this school that indicate technical support as the major role of the TRT. The TRT in School 2 perceives the TRT role as helping teachers and students to pass the computer competency tests. Teachers in this school also perceive the major role of the TRT to be in training them for the computer competency tests.

The Role of Technology Resource Teachers in Integration of Technology into the Classroom

How do teachers use technology? The results from the general survey show that more than 50% of teachers who responded to our survey have a home computer, 60% have had previous computer courses or workshops, more than 47% have had between 40 to 20 hours of computer workshops at their school, and 81% have a computer in their classroom. A chi-square test of categorical data showed no significant differences between schools with respect to the above variables (n=17).

The analysis of teachers' responses to open-ended questions in the general survey reveals some useful information. While usage of computers varies slightly from one school to the next, the majority of the teachers who are using their classroom computers indicate that they are mainly using word-processing and subject-matter software (see Table 7). Enrichment/remediation and keyboarding rank next as the third and the fourth most common applications of the computer usage in the classroom. This result is consistent with the result of the closed-ended items which asks a similar question. The highest percentage of classroom computer usage is for remediation and enhancement of students learning. Preparing hand-outs and other visual presentation rank as the second and third forms of classroom computer usage (see Table 8). The interview and observation data also reveal that word-processing, games and subject-specific software for remediation purposes are those areas of computer application primarily used by students when teachers and students are using in computer labs.

Table 2 also shows that teachers across different schools rate their word processing skills as the strongest computer skills, while they rate telecommunications as their weakest computer skill area. (There were no significant difference among the six schools on this variable). Comparison of this result with the above outcome attests that teachers are using computers in their classrooms in the areas that they have acquired the skills and knowledge to do so.

Analysis of interview data also indicates that while a number of teachers at each school responded favorably to the TRTs' initiatives to use the computer lab for an integrated lesson, the majority of teachers are still at the starting point with respect to both computer usage and the integration of computers into their curriculum.

> This has probably been harder to convince people that it is possible. I think a lot of that is a function of teachers' skill level. I feel like I have been really successful in some situations because teachers were just open and wanting (TRT, School 6)

> A lot of teachers are coming in (lab). . . . they are sending interim reports on the computer. I see a lot of that type of things going on. (TRT, School 2)

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Some are doing it now. I have got some that are just wonderful. They do a good job with it now. Others I think it is just a matter of they need to be shown what to do with it. They are so used to doing their own things that it would be hard to do something else. (TRT, School 1)

There are some folks that would like to work with it (computers) but still hesitate to do things on their own. So I have to go and pull them in. Sometimes you just have to go and say, "I think we can do this." They don't know what they can do. (TRT, School 3)

As the above excerpts show, the TRTs think it will take time for teachers to learn how to integrate computers into their curriculum. The major problems that TRTs see with respect to teachers who are reluctant to use computers are: not enough time to learn about computers, not knowing the application(s) of computers in their subject matter area, and not seeing the benefit of computer programs for students' learning. The majority of TRTs believe that all of the above problems can be solved by informally approaching teachers and helping them plan an integrated lesson and implement it successfully.

Teachers were also asked to explain the reasons they selected certain computer skills as their weakest areas. The majority of teachers indicated that they need more training, time, and opportunity to practice the skills that they have learned in order to be able to use computers in their classroom (see Table 9). This is their perception, although at the time of the survey, 47% of teachers had already completed 20 to 40 hours of computer workshops and 81% had taken previous computer courses. From these figures and the above findings, it appears that training workshops are only the beginning point for most teachers. In order for teachers to use computers and integrate them into their curriculum, they need practice over a long period, as the TRTs pointed out.

How do teachers feel about technology? A total of 206 teachers across schools completed the CLA survey at the end of the 1994-95 school year. This was after having TRTs in their respective schools during that year. The survey contained items related to liking computers, valuing computers for society and education; anxiety about using computers; confidence with regard to learning and using computers; and perceptions of gender appropriateness of computers. Teachers were asked to rate the items from "Strongly Agree" to "Strongly Disagree". In addition to Likert-scale items, teachers were also asked several background questions. A summary of the responses to these questions is presented in Table 10.

The results of attitude survey show that teachers have a fairly positive attitude toward computers. Appendix B summarizes the means of all teachers responses to Computer Attitude Survey. As the means scores shows teachers seem to like computers, value computers for education and society and have confidence about learning and using computers. However, they still have some anxiety about computers (Average M= 4.00 where 5=Strongly Disagree). A repeated measure of attitude is required to determine any changes in teachers' attitude over time.

A correlation analysis of different items related to liking computers, valuing computers for society and education, anxiety about using computers, confidence with regard to learning and using computers, previous experience with computers, ratings of computer skills at present and before the school year, and current usage of computers in the classroom revealed some interesting findings. Tables 11 to 16 summarize the results of this analysis. As these tables show, teachers who rated their computer skills higher, liked computers more, had more confidence for learning computers, valued computers for the society and education more than others, and had less anxiety about using computers. Findings also showed correlations between confidence for learning computers and the level of anxiety for using computers. Teachers who felt more confident learning and using computers tended to have less anxiety for computers. Teachers who had previous experience with operating computers also showed more confidence for using computers. Table 16 shows that teachers who had completed more hours of training workshops tended to rate their computer skills higher than others.

An analysis of multivariance was also conducted to investigate the combined effects of different categories of attitude toward computers at different schools, the usage of computers in the classroom, different levels of previous computer experiences, and different levels of computer skills. Since the response rate was not equal for each school, a random sample of 24 responses was selected from each school for this analysis. Tables 17 through 21 show the means

and standard deviation for each dependent variable. The result of the multivariate tests are also presented in Table 22. As Table 17 shows, the difference between schools across variables such as liking computers, value for computers in education, confidence for learning and using computers, and anxiety for computers is not significant.

We also investigated the combined effects of the above variables represented in the attitude survey on the current usage of computers in the classroom. Table 18 shows means and standard deviations for each dependent variable. The results of a multivariate test is also presented in Table 22. As the table shows, the difference between the teachers who are currently using computers and the teachers who are using computers across different ?? attitude measures was significant. The univariate test shows that teachers who are currently using computers in their classroom, like computers more, and value computers for education more than those who are not using computers in their classroom. The anxiety and the confidence for using computers is not, however, significantly different for those who are using computers in their classrooms and those who are not using computers in their classrooms.

Table 22 also shows that there is a significant difference between teachers who had previous experiences with operating computers and those who did not on categories such as liking computers, confidence for using computers, and anxiety for computers. In other words, teachers who had over a year of previous experience with computers liked computers significantly more, had less anxiety toward computers, and had a higher level of confidence for using computers than those who had no previous experience (see Table 19). However, this difference was not significant for categories such as value for computer in education and confidence for learning computers.

Finally, as presented in Table 22, there was a significant difference between the attitude of teachers toward computers (on all categories except for the value for computer in education) and the level of computer skills. In other words, teachers who rated their computer skills highest before and after the school year liked computers more, had more confidence learning and using computers, and felt less anxiety towards computers (see Table 20 and 21).

In sum, although the statistical analysis of the attitude survey revealed some very interesting results, it failed to demonstrate any significant differences between attitude of teachers toward computers at different schools. Usage of computers in the classroom, previous computer experience, and skills in using computers are identified as factors that had effects on teachers' general attitudes toward computers.

Discussion

This study has been conducted to explore the roles and responsibilities of the TRT, and the effects that the TRT's role has on the integration of technology in the classroom. It also sought to examine how the TRT's role differed from that expected of instructional designers/technologists, if they were to be involved in public schools; and to explore what an instructional technologist would have done if he/she was assigned to this position.

The study showed that the role and responsibilities of TRTs are primarily instructional, although technical and administrative responsibilities are also expected. Excellent communication skills, the ability to understand the dynamics of teaching and the role of teachers, and being able to work closely with the classroom teachers appeared to be vital characteristics contributing to the success of the TRT, particularly as they affected the classroom teachers' acceptance of and openness towards the technology. In addition, familiarity with the school context appears to enhance the readiness for success, both through the TRT's ability to understand and analyze where the teachers' progress lies, and through the classroom teachers' comfort level for working with the TRT. Although the TRTs estimated that they spent around 75% of their time on technical support and the county administrators expected a high level of technical expertise in the requirements for selecting a TRT, the study indicated that the nature of the TRTs role was more instructional than technical. For example, the teachers' expectations of the TRT was one of instructional support through training, workshops, and demonstration of the applications of the computer. Furthermore, the TRTs felt that their next phase would result in much less technical work and much more instructional work in the integration of technology into the classroom.

As an instructional support system, each TRT used some strategies to help teachers in his or her school integrate computers into their curriculum. Although TRTs' instructional strategies were somewhat different, their primary

instructional strategies were: providing training workshops, teaching integrated lesson to students while teachers were present, approaching teachers informally to help them and give them new ideas, and encouraging teachers to schedule their classes for the computer lab. However, while teaching computer skills to teachers and students was the TRTs' major instructional activity, the findings of the study indicated that TRTs did not conduct a needs analysis at the school. They did not prioritize the needs, they did not have specific objectives, nor did they have a planned action for implementation and evaluation. Instead, they applied an intuitive and informal understanding of the needs to initiate the strategies or support. They provided training workshops based on their own understanding of the teachers' needs, informally monitored the process, and used more of the collegial relationships with teachers to help them integrate technology.

As an instructional designer, when one approaches the task, one approaches it first by identifying the problem through a formal analysis of needs to determine if there is an instructional solution to the problem. Instructional designers then proceed with the design of instruction to meet the needs of the learners, monitor the process, evaluate the results, and revise, if necessary. While it is premature to determine if TRTs' strategies for helping teachers integrate technology was effective, data show that the TRTs are able to develop a rapport with teachers which enabled teachers to feel comfortable working with the TRT, working in the computer lab, and to more willingly approach utilizing technology in their instruction.

Had the TRTs been trained in the field of instructional design, they would have combined their knowledge of the school environment, their teaching experience in the school, and familiarity with the teachers with an analytical, systematic, and evaluative approach in their efforts to help teachers both: (1) integrate technology, and (2) learn the required technology skills necessary to do so. Since the goals of the TRTs were derived from the state's predefined and mandated competency test, the TRTs' approach was reactive rather than proactive. A more proactive, systemic, as well as systematic approach could have resulted in more integration of computers into curriculum. The lack of a formal statement of needs that is based on the analysis of the problem in each school and formal measures did not allow TRTs to monitor or assess the achievement or appropriateness of their goals and strategies, nor did it provide them with opportunity to revise their plan of action .

Implications

If public schools would like to use the time and the money efficiently, they need to use professionals who have not only the characteristics of the TRTs but also skills in instructional design. The study has also implications for instructional technology field.

First of all, in the field of instructional design/technology, more emphasis needs to be placed on the role of instructional designer in the public schools. The results of this study suggest that public schools may be ready to use instructional design skills that for a long period of time had not been utilized. From the findings of this study, the following suggestions may be pertinent to the field.

1. Recruit Educators to Become Potential Instructional Designers in the Public Schools

In order for instructional design to be successfully implemented in schools, the field should place more emphasis on public school settings and recruit newcomers to the field directly from the pool of educators from the school system. The answer may not lie in simply sending newly trained instructional designers into the schools, particularly since this study indicates the importance being familiar with the school system, the school context, and the characteristics of teachers and teaching practices.

2. Include a Public School Internship Component to Instructional Technology Programs

Another way that the instructional design field can aim their efforts towards helping public schools is to include a public school internship requirement in current programs. The majority of graduate programs in instructional design/technology usually require students to complete an internship in business, industry, government, or military

settings. Potential applicants interested in public school settings should be required to complete their internship in a public school or schools.

3. Provide Inservice Instructional Technology Training for Public School Teachers

Given that there is an overwhelming demand for public school educators and their students to have computer skills, the instructional technology field can take the leadership and responsibility for providing that training. One of the problems that has kept instructional designers from public education has been the lack of funding to pay for such expertise. Schools and the instructional design field should become partners in their attempts to obtain grants and funding means to support such training efforts.

4. Target Potential Employment Opportunities Such as Technology Coordinator, Technology Resource Teacher, and Other Public School Technology Positions

The results of this study combined with current trends in education suggest that the public school community is ready to use professionals from the field of instructional design. While the schools in this study have such positions in place, other schools in the state and across the nation will be working to solve technology integration problems that will probably result in similar job positions. The field of instructional design may have a rich opportunity at last to affect public schools.

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Appendix A (continued)

Computer Survey

Instructions: Mark all responses on your bubble sheet using a #2 pencil only. The bubble sheets are anonymous and do not require your name, birthdate, identification number or grade or education. However, we would appreciate it if you would please indicate whether you are male or female in the appropriate area on the bubble sheet. Please do not make marks on this questionnaire.

Answer each question as it applies to you at *this* point in your learning and teaching experiences. Your answers will not be shared with anyone and will be kept anonymous.

1. What grade levels do you teach?

   a. 6th grade
   b. 7th grade
   c. 8th grade

2. What subject areas do you teach?

   a. Mathematics
   b. Social Studies
   c. Science
   d. Language Arts
   e. Other

3. Are you seeking CEU credit for the computer competency workshops that you take?

   a. Yes
   b. No

4. How many hours of computer workshop training have you completed?

   a. Less than 10 hours
   b. 10-20 hours
   c. 20-30 hours
   d. 30-40 hours

5. Are you currently using computers in your classroom?

   a. Yes
   b. No

6. Before this year, what previous experience have you had in operating computers?

   a. 0
   b. Few days to 1 month
   c. 1-6 months
   d. 7 months to a year
   e. Over a year

7. Describe your home computer:

a. Macintosh
b. IBM Compatible
c. Apple II
d. Other
e. None

8. How would you rate your computer skills before the school year started?

a. Nonexistent
b. Poor
c. Average
d. Good
e. Excellent

9. How would you rate your ability to use a computer now?

a. Nonexistent
b. Poor
c. Average
d. Good
e. Excellent

Answer the next set of items according to how much you **agree** or **disagree** with the statements as follows:

a. strongly agree
b. agree
c. neutral
d. disagree
e. strongly disagree

10. Knowing how to use computers is a worthwhile and necessary skill.

11. I like using computers.

12. I feel confident about my ability to learn about computers.

13. Working with a computer makes me nervous.

14. I will use my knowledge of computers in many ways as a teacher.

15. Using a computer is more important for males than females.

16. I like using computers in my school work.

17. I wish I could use computers more frequently at the school.

18. I get a sinking feeling when I think of trying to use a computer.

a. strongly agree
b. agree
c. neutral
d. disagree
e. strongly disagree

19. Once I start to work with the computer, I would find it hard to stop.

20. Computers make me feel stupid.

21. If a problem is left unsolved in a computer workshop or in class, I would continue to think about it afterwards.

22. More men than women have the ability to become computer scientists.

23. Teaching using computers would be very interesting.

24. I don't expect to use computers in my classroom.

25. I look forward to using the computers at school.

26. I'm not the type to do well with computers.

27. I feel comfortable using computers.

28. Working with computers is boring.

29. Using computers is more enjoyable for males than females.

30. When there is a problem with a computer program I can't immediately solve, I would stick with it until I have the answer.

31. Learning about computers is a worthwhile and necessary subject for all teachers.

32. Computers make me feel uncomfortable.

33. It is important to know how to use computers in order to get any teaching position.

34. I know that if I work hard to learn about computers, I can do well.

35. Females can do as well as males in learning about computers.

36. Computers make me feel uneasy and confused.

37. I think working with computers would be both enjoyable and stimulating.

38. I think using a computer would be difficult for me.

39. Working with computers is more for males than females.

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40. I am able to do as well working with computers as most of my fellow teachers.

a. strongly agree
b. agree
c. neutral
d. disagree
e. strongly disagree

41. I will probably need to know how to use a computer in my classroom.

42. Computers are gaining too much control over people's lives.

43. Supplying every student with a computer is a worthy educational objective.

44. Teachers should demand that they be taught how to use a computer in their classrooms.

45. Computers will require learners to become active in their learning.

46. Computer instruction will deny students the opportunity to reason with others.

47. Using computers as a teaching tool puts too much additional work on already overburdened teachers.

48. If we do not use computers in school instruction, our students will grow up illiterate and deprived of a basic skill.

49. If my school district had the money, I would insist that they buy computers in most every school subject.

50. Computers will increase the amount of stress and anxiety teachers experience in schools.

51. Computers will decrease the amount of teacher-pupil interaction in schools.

52. Computers will isolate students from one another.

53. I object to all the attention being given to computer technology because it detracts from the real problems now faced by teachers.

54. Computers can improve learning of higher-order skills.

55. Computers will displace teachers.

56. Computers will dehumanize teaching.

57. Our country would be better off if there were no computers.

58. Someday I will have a computer in my home.

59. Computers will improve education.

Appendix B

Teachers' Attitude Toward Computers--Mean and Standard Deviation Scores.

Liking Computers		M	SD
11.	I like using computers.	1.63	.94
16.	I like using computers in my school work.	1.82	1.02
17.	I wish I could use computers more frequently at the school.	1.82	.94
19.	Once I start to work with the computer, I would find it hard to stop.	2.40	1.14
21.	If a problem is left unsolved in a computer workshop or in class, I would continue to think about it afterwards.	2.41	1.10
23.	Teaching using computers would be very interesting.	2.09	1.07
25.	I look forward to using the computers at school.	1.90	.97
30.	When there is a problem with a computer program I can't immediately solve, I would stick with it until I have the answer.	2.53	1.11
37.	I think working with computers would be both enjoyable and stimulating.	1.88	.91
58.	Someday I will have a computer in my home.	1.63	.95
28.	Working with computers is boring. (Negative item)	4.25	.91

Value of Computer for Education		M	SD
Positive Items			
14.	I will use my knowledge of computers in many ways as a teacher.	1.88	1.03
31.	Learning about computers is a worthwhile and necessary subject for all teachers.	1.58	.90
33.	It is important to know how to use computers in order to get any teaching position.	2.80	1.16
43.	Supplying every student with a microcomputer is a worthy educational objective.	2.12	1.12
44.	Teachers should demand that they be taught how to use microcomputers in their classrooms.	2.09	.95
45.	Microcomputers will require learners to become active in their learning.	2.02	.96
48.	If we do not use microcomputers in school instruction, our students will grow up illiterate and deprived of a basic skill.	2.60	1.23
49.	If my school district had the money, I would insist that they buy microcomputers in most every school subject.	2.18	1.07
54.	Computers can improve learning of higher-order skills.	1.95	.89
57.	Our country would be better off if there were no computers.	1.95	.89
59.	Computers will improve education.	1.70	.90
Negative Items			
46.	Microcomputer instruction will deny students the opportunity to reason with others.	3.75	1.03
47.	Using microcomputers as a teaching tool puts too much additional work on already overburdened teachers.	3.56	1.16
50.	Microcomputers will increase the amount of stress and anxiety teachers experience in schools.	3.51	1.10
51.	Microcomputers will decrease the amount of teacher-pupil interaction in schools.	3.71	1.05
52.	Microcomputers will isolate students from one another.	3.82	.91
53.	I object to all the attention being given to computer technology because it detracts from the real problems now faced by teachers.	3.60	1.17

55.	Computers will displace teachers.	4.14	.96
56.	Computers will dehumanize teaching.	3.96	1.00
Value of Computer for Society		M	SD
Positive Items			
10.	Knowing how to use computers is a worthwhile and necessary skill.	1.29	.71
41.	I will probably need to know how to use a computer in my classroom.	1.63	.93
Negative Items			
24.	I don't expect to use computers in my classroom. (Negative)	4.37	.91
42.	Computers are gaining too much control over people's lives. (Negative)	3.41	1.20
Confidence about Learning Computers		M	SD
12.	I feel confident about my ability to learn about computers.	1.78	.96
34.	I know that if I work hard to learn about computers, I can do well.	1.60	.71
Confidence About Using Computers		M	SD
27.	I feel comfortable using computers.	2.11	1.14
40.	I am able to do as well working with computers as most of my fellow teachers.	1.98	1.02
Anxiety (or Lack of it) about Computers		M	SD
Negative Items			
13.	Working with a computer would make me nervous.	3.52	1.31
18.	I get a sinking feeling when I think of trying to use a computer.	4.06	1.15
20.	Computers make me feel stupid.	4.04	1.15
26.	I'm not the type to do well with computers.	4.13	1.00
32.	Computers make me feel uncomfortable.	3.93	1.16
36.	Computers make me feel uneasy and confused.	3.97	1.11
38.	I think using a computer would be difficult for me.	4.09	1.04
Perception about Gender-Appropriate of Computer Use		M	SD
15.	Using a computer is more important for males than females.	4.58	.92
22.	More men than women have the ability to become computer scientists.	4.61	.73
29.	Using computers is more enjoyable for males than females.	4.54	.83
35.	Females can do as well as males in learning about computers.	1.47	.93
39.	Working with computers is more for males than females.	4.60	.72

Note: For positively-worded statments 1=strongly agree and for negatively-worded statements 5=strongly disagree.

Table 1
Cross tabulation of computer competency exams taken by teachers by school.

Question	Schools 1 (n=17)	2 (n=17)	3 (n=17)	4 (n=17)	5 (n=17)	6 (n=17)
How many hours of computer workshops have completed?	16.0	17.0	16.0	17.0	17.0	17.0
Which of the following computer competency exams have you taken?						
• Keyboarding	14.3	25.7	8.6	11.4	11.4	28.6
• Operating	19.2	34.6	4.5	13.6	9.1	13.6
• Word-processing	22.7	36.4	4.5	13.6	9.1	13.6
• Spreadsheet	23.1	30.8	3.8	7.7	11.5	23.1
• Data base	23.8	42.9	0.0	4.8	9.0	19.0

Table 2
Means and standard deviations of teachers' different computer skills by school.

Question	Schools 1 (n=17) M (SD)	2 (n=17) M (SD)	3 (n=17) M (SD)	4 (n=17) M (SD)	5 (n=17) M (SD)	6 (n=17) M (SD)
List the following computers skills in order of your strongest areas to your weakest area (1= strongest and 9= weakest)						
• Terms and operations	**2.7** (1.9)	**4.0** (2.3)	**3.0** (2.0)	**3.4** (1.6)	**3.8** (2.3)	**4.6** (2.6)
• Keyboarding	**3.6** (2.7)	**2.2** (2.0)	**2.3** (2.1)	**1.7** (1.2)	**4.3** (2.6)	**2.7** (2.5)
• Societal uses	**5.8** (1.9)	**5.5** (2.5)	**5.5** (2.6)	**6.4** (1.7)	**6.4** (2.0)	**4.3** (2.1)
• Ethics	**5.6** (2.4)	**5.5** (2.7)	**5.2** (2.3)	**5.7** (2.5)	**6.4** (2.5)	**3.6** (2.3)
• Word-processing	**3.8** (2.4)	**2.7** (2.2)	**1.7** (1.0)	**2.0** (0.9)	**3.1** (2.5)	**3.6** (2.3)
• Data bases	**6.0** (2.0)	**5.2** (1.8)	**4.5** (1.8)	**6.0** (1.9)	**5.6** (2.2)	**6.0** (1.6)
• Spreadsheets	**5.6** (2.1)	**5.2** (1.8)	**4.6** (2.7)	**5.0** (2.3)	**5.2** (2.4)	**6.1** (1.6)
• Curriculum software use	**5.6** (2.2)	**5.7** (2.2)	**5.0** (2.3)	**5.7** (1.8)	**4.6** (1.8)	**5.1** (2.5)
• Telecomputing	**8.0** (2.7)	**8.2** (0.8)	**7.7** (2.4)	**8.2** (1.3)	**6.8** (2.6)	**8.3** (1.2)

Table 3
Cross tabulation of previous experiences in computer by school.

Questions	Schools 1 (n=17)	2 (n=17)	3 (n=17)	4 (n=17)	5 (n=17)	6 (n=17)
Have you had any previous computer course/workshop prior to the school-based computer training program?	14.1	20.3	17.2	12.5	15.6	20.3
Describe your computer skills prior to your training this school year.	17.0	16.0	17.0	17.0	17.0	17.0
17.0 %• I feel I had all						
58.0 %• I feel I had some	(4)	(1)	(3)	(3)	(6)	(0)
25.0 %• I feel I had none	(10)	(8)	(10)	(9)	(6)	(15)
	(3)	(7)	(3)	(5)	(5)	(2)
Please describe your computer skills at the present time.	17.0	17.0	15.0	17.0	17.0	17.0
27.0%• Confidence in all	(4)	(6)	(4)	(3)	(7)	(3)
49.0%• Confidence in some	(8)	(8)	(9)	(11)	(3)	(10)
24.0%• Need additional	(5)	(3)	(2)	(3)	(7)	(4)

Table 4
Summary of Teachers' Perception of the Role and Responsibilities of Resource Teachers and Summary of Resource Teacher's Perception of his/her Role and Responsibilities.

School	Teachers' Perception of Resource Teacher	%	Resource Teacher's Perception of his/her Role
School 1	• Always there to help and suggest/Advise/Assist teachers/students	52	• Teach teachers to plan lessons for teaching computer competency test
	• Conducts workshops/Provides training sessions	16.6	• Help teachers to come up with new ideas to use technology in their curriculum
	• Staff developer	13.0	• Help teachers in computer lab
	• Teaches specific lessons	8.7	• Maintain computer lab operation
	• Direct group instruction/Coordinates activities/Newsletters	8.7	• Troubleshooting
	• Problem-fixer/Trouble shooter with computers	8.7	
	• Mentor/Facilitator	4.3	
	• Answers questions concerning computer programs	4.3	
	• Willing to help in any area	4.3	

Table 4. (continued)

School	Teachers' Perception of Resource Teacher	%	Resource Teacher's Perception of his/her Role
School 2	• Assist or aids teachers in the use and teaching of computers/ teaches computing skills	30.8	• Train teacher for computer competency test • Prepare students for computer competency tests
	• Creates certificates/helpful for competency exam	7.7	• Install New Software
	• Helps/Assists with technology lessons	7.7	• Troubleshoot • Keep track of hardware and software
	• Facilitate instruction/Technology facilitator	7.7	
	• Aids in teacher performance	3.8	
	• Provides workshops	3.8	
	• Keeps hardware running, installs and orders software	3.8	
	• Manages computer lab	3.8	
School 3	• Troubleshooter/Fixer	27.8	• Provide technical support
	• Helps teacher/students with computer skills and competency test	22.2	• Train students for taking computer competency test
	• Facilitator	11.1	
	• Tutor/Trainer	11.1	
	• Provides support to teachers/Answers questions	11.1	
	• Gives lessons to kids and teachers	11.1	
	• The one and only genius		
	• Runs computer lab	5.6	
	• Seems quite knowledgeable in most aspects	5.6	
	• Discusses and teaches NC computer competency objectives	5.6	

Table 4 (continued)

School	Teachers' Perception of Resource Teacher	%	Resource Teacher's Perception of her/his Role
School 4	• Teaches computer skills to both staff and students/Helps teacher and students become computer literate	32.3	• Help teachers plan lessons to integrate computer • Help and teach computer skills to students for computer competency test • Maintain computer lab operation • Train teachers for taking computer competency test • Provide workshop
	• Helper/Never too busy to help/Most helpful to all/God's Send to us/Invaluable/Essential	29.0	
	• Technical advisor/trouble shooter	12.9	
	• Computer specialist/Responds to all of our computer needs	9.7	
	• Resource for software/Helps us find software	9.7	
	• Life saver/Our savior	6.5	
	• Offers suggestions/Provides support	6.5	
	• Facilitator	6.5	
	• Helpful with training	6.5	
	• Assists teachers in planning for computer lab	3.2	
	• Guides classroom instruction	3.2	
School 5	• Assist with student instruction/Teaches computer language to students/Design lesson for students	18.8	• Basically troubleshooting in classrooms • I want to be a friendly person that teachers feel comfortable coming to • I don't want to be perceived as a nuts and bolts hardware person
	• Facilitator for computers and computer instruction	18.8	
	• Work with teachers and students on computer skills/usage	14.6	
	• Great resource to help and support	12.5	
	• Trainer/Provide training for teachers/ Provide workshop	10.4	
	• Troubleshooter/Technician	8.3	
	• An expert to consult with	8.3	
	• Help students and teachers with any questions/new information	8.3	
	• Assist teachers in finding materials for use with classes	6.3	

Table 4 (continued)

School	Teachers' Perception of Resource Teacher	%	Resource Teacher's Perception of her/his Role
School 6	• Provides computer workshops/Trains teachers and provides enrichment/Trains teachers in technology	36.6	• Show teachers what technologies we have and how they can utilize them • Convince teachers that they save time by using computers
	• Teacher of teachers/Assistant to teachers and students	27	• Lots of troubleshooting • Make teachers feel comfortable with computers and with their computer skills
	• Troubleshooter/keeps computers in working order	23	
	• Facilitator/Rescuer	16.6	• Make teachers comfortable to bring their students to computer lab
	• Helps plan and implement computer lab lessons/Consultant for class activities/Teaching or introducing new skills to students	16.6	
	• Helps teach lessons/Helps teach classes and answer questions	16.6	
	• Install and maintain computer programs/software	6.7	
	• Too vast to mention/Is other half of my brain	6.6	
	• Keeps us abreast of technology		
	• Assist with technical problems	6.6	
	• Is omniscient in computer lab	6.6	
	• Aids in the use of computer for instruction	3.3 3.3	

Table 5

Summary of teachers' responses to the question "In what ways TRT help you with computer usage?."

Categories of Responses	School # 1	School # 2	School # 3	School # 4	School # 5	School # 6	Average
1. Finding proper software/ updating software.	34.8% (8)	11.1% (3)	16.7% (3)	3.2% (1)	16.7% (8)	13.3% (4)	16.0%
2. Available all the time to help with what we want.	26.1 (6)	7.4% (2)	16.7% (3)	16.1% (5)	4.2% (2)	26.7% (8)	16.2%
3. Teaching how to use computer/teaching computer competency test.	13.0% (3)	11.1% (3)	16.7% (3)	19.4% (6)	4.2% (2)	26.7% (8)	15.2%
4. Helping through staff development and workshops.	17.4% (4)	18.5% (5)	16.7% (3)	6.5% (2)	10.4% (5)	16.7% (5)	14.4%
5. Trouble shooting	13.0% (3)	0.0% (0)	22.2% (4)	16.1 (5)	8.3% (4)	16.7% (5)	12.7%
6. Answering question about technology.	26.1% (6)	7.4% (2)	0.0% (0)	12.9% (4)	4.2% (2)	16.7% (5)	11.2%
Total number of observations	**23**	**27**	**18**	**31**	**48**	**30**	

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Table 6
Resource Teachers' versus Teachers' Perceptions of TRT Role

Job Description Role and Responsibility	Technology Coordinators' Perception	Principals' Perception
Instructional 8 phases Technical 4 phases Administrative 5 phases **Instructional** •teach introductory and computer related lesson •assist teachers in selecting and using materials and equipment suitable for grade level •update computer curriculum •assist teachers in integrating computer activities •assist teachers in implementing special projects with multimedia, publications, telecommmunications •teaching demonstration lessons with more software •assist teachers with understanding of computers •responsibie for helping teachers pass competency test **Technical** •supply technical expertise •troubleshooting computers, printers, etc. •serve as consultant for purchasing equipment •install new equipment **Administrative** •distribute copies of items and state licenses •distribute documentation of district owned and licenses software •maintain a schedule for computer lab •work with media specialist to keep inventory •work with technology department as a member **Qualifications** •knowlege in the application of instructional technology •experience in working with teachers •at least three years teaching experience	•we looked at technical skills and hardware and software knowledge •we really concentrated a lot on skills of working with DOS, to do training with DOS which would be intimidating to adults •we did not focus on years of teaching (3 years teachings is one of the job qualifications for the position) •we just want somebody who has solid background with good skills in technology •they need to be very personable and be able to work with people •they should have had some experience in training adults	•I would want somebody very comfortable in technology •Technical knowledge •Someone who can interface with people and has good people skills •Human rapport and understanding of teachers •Someone in-house on faculty so transition would be easier •Warm and nuturing personality, not intimidating •Committed to staff and students •A teacher and facilitator

Table 7
Summary of teachers' responses to the question "Describe how you use the computer in your classroom to aid students learning within the subject area you teach."

Categories of Responses	School # 1	School # 2	School # 3	School # 4	School # 5	School # 6	Average
1. Use subject matter related software	21.7% (5)	3.7% (1)	22.2% (4)	22.6% (7)	27.1% (13)	26.7% (8)	21.0%
2. Use word-processing software	34.8% (8)	14.8% (4)	22.2% (4)	29.0% (9)	10.4% (5)	10.0% (3)	20.2%
3. Use for remediation, enrichment	43.5% (10)	3.7% (1)	11.1% (2)	16.1% (5)	10.4% (5)	13.3% (4)	16.4%
4. Use for keyboarding	13.0% (3)	7.4% (2)	0.0% (0)	3.2% (1)	0.0% (0)	6.7% (2)	5.1%
5. Use for lesson planning/tests/ transparencies	0.0% (0)	3.7% (1)	5.6% (1)	6.5% (2)	6.3% (3)	6.7% (2)	4.8%
6. use games for reinforcement/ motivation.	4.4% (1)	7.4% (2)	0.0% (0)	3.2 (1)	2.1% (1)	6.7% (2)	4.0%
Total number of observations	**23**	**27**	**18**	**31**	**48**	**30**	

Table 8
Cross tabulation of classroom computer and its usage by school.

	School					
Questions	**1** (n=17)	**2** (n=17)	**3** (n=17)	**4** (n=17)	**5** (n=17)	**6** (n=17)
Do you have computer in your classroom?	17.4 (15)	16.3 (14)	15.1 (13)	19.8 (17)	15.1 (13)	16.3 (14)
Is your classroom computer compatible with the other computers in your school and with the computer lab?	18.8	16.3	15.0	20.0	15.0	15.0
Do you have any software in your classroom?	16.9	18.3	18.3	15.5	14.1	16.9
Which of the following describes how you are using your classroom computer and educational software?						
• Design visual presentation	8.3	8.3	12.5	16.7	25.0	29.2
• Prepare hand-outs & print	15.1	18.9	17.0	17.0	15.1	17.0
• For remediation	28.1	15.6	18.8	6.3	18.8	12.5
• Enhance learning	20.0	14.0	18.0	16.0	16.0	16.0

Table 9
Teachers' responses to the question "Why have you selected certain areas as your weakest areas?."

Categories of Responses	School # 1	School # 2	School # 3	School # 4	School # 5	School # 6	Average
1. Lack of experience.	30.4% (7)	33.3% (9)	27.8% (5)	3.2% (1)	45.8% (22)	56.7% (17)	32.9%
2. Need more instruction.	43.5% (10)	3.7% (1)	27.8% (5)	3.2% (1)	31.3% (15)	16.7% (5)	21.0%
3. Lack of facilities.	0.0% (0)	0.0% (0)	3.7% (1)	0.0% (0)	0.0% (0)	0.0% (0)	3.7%
Total number of observations	**23**	**27**	**18**	**31**	**48**	**30**	

Table 10
Results of background questions in the Computer Attitude Survey before equalizing the sample size across schools.

Questions	Responses				
1. What grade level do you teach?	6th (43) 21%	7th (46) 22%	8th (45) 21%	Others (62) 35%	
2. What subject areas do you teach?	Math (26) 12.6%	Science (19) 9.2%	LA (38) 18.4%	Social Studies (14) 6.8%	Other (109) 52
3. Are you seeking credit for computer competency workshop that you take?	Yes (160) 77.7%	No (39) 18.9%			
4. How many hours of computer workshop training have you completed?	>10 (45) 21.8%	10-20 (74) 35.9%	20-30 (36) 17.5%	30-40 (50) 24.3%	
5. Are you currently using computers in your classroom?	Yes (168) 81.6%	No (37) 18%			
6. Before this year, what previous experience have you had in operating computers?	0 (23) 11.2%	Few days to 1 M (32) 15.5%	1-6 M (17) 8.3%	7 M to1 Y (16) 7.8%	Over 1 Y (118) 57.3%
7. Describe your home computer.	Mac (10) 4.9%	IBM (92) 44.7%	Apple (5) 2.4%	other (18) 8.7%	None (75) 36.4%
8. How would you rate your computer skills before the school year started?	None (19) 9.2%	Poor (63) 30.7%	Average (69) 33.5%	Good (42) 20.4%	Excellent (13) 6.3%
9. How would you rate your ability to use computer now?	None (5) 2.4%	Poor (35) 17.0%	Average (78) 37.9%	Good (64) 31.1%	Excellent (24) 11.7%

Table 11
Correlation between liking computers and other variables

Variables	N	R
Liking computers vs. value for computers	133	.2851*
Liking computers vs. confidence for learning computers	134	.6542*
Liking computers vs. confidence for using computers	134	.6569*
Liking computers vs. value for computers in education	133	.2851*
Liking computers vs. rate computer skills before this year	135	.4760*
Liking computers vs. rate using computers now	135	.5024*
Liking computers vs. previous experience with operating	135	.3725*
Liking computers vs. current usage of computer in class	135	.2482*

*P<.001

Table 12
Correlation between confidence for learning computers and the other variables

Variables	N	R
Confidence for learning computers vs. value for using computers	141	.6534*
Confidence for using computers vs. confidence for learning computers	141	.6534*
Confidence for learning computers vs. rate computer skills before this year	142	.3823*
Confidence for learning computers and rate ability using computers now	142	.5056*
Confidence for learning computers vs. previous experience with computers	204	.2652*

*p<.005

Table 13
Correlation between value for computers in education and other variables

Variables	N	R
Confidence for using computers vs. previous experience with computers	142	.5050*
Confidence for using computers vs. rate computer skills before this year	142	.6320*
Confidence for using computers vs. rate ability using computers now	142	.6400*
Confidence using computers vs. hours of computer competency workshop	141	.3001*

*p<.001

Table 14
Correlation between anxiety for computer and the other variables

Variables	N	R
Anxiety for computer vs. liking computers	134	.5486*
Anxiety for computers vs. confidence for learning computers	141	.5928*
Anxiety for computers vs. confidence for using computers	142	.7685*
Anxiety for computers vs. rate computer skills before this year	142	.5758*
Anxiety for computer vs. rate ability to use computers now	142	.5486*

*p<.001

Table 15
Correlation between rate of computer skills and other variables

Variables	N	R
Rate of computer skills vs. hours of computer competency workshops	143	.2642*
Rate computer skills before this years vs. rate ability to use computers now	144	.7269*
Rate ability to use computer vs. hours of computer competency workshops	143	.3229*

*p<.001

Table 16:
Correlation among variables in general survey.

Variables	R	P value
Home computer vs. computer skills at present	.3007	.01
Home computer vs. computer skills prior to training	.2630	.01
Home computer vs. home computer usage	.5372	.01
Home computer usage vs. computer skills prior to training	.2543	.05
Home computer usage vs. computer skills at present	.2605	.05
Computer skills prior to training vs. computer skills at present	.6856	.01
Computer skills at present vs. hours of computer workshop	.3930	.001

Table 17
Descriptive statistics for teachers' attitude toward computer by six different schools

Factors measured teachers' attitude toward computers	School 1 (n=24) M (SD)	School 2 (n=24) M (SD)	School 3 (n=24) M (SD)	School 4 (n=24) M (SD)	School 5 (n=24) M (SD)	School 6 (n=24) M (SD)
1. Liking computers	**24.2** (4.8)	**25.6** (4.9)	**22.9** (5.7)	**25.6** (8.2)	**21.1** (6.5)	**24.2** (6.7)
2. Value for computer in education	**49.5** (4.6)	**49.5** (3.6)	**50.0** (2.8)	**50.7** (4.0)	**48.8** (6.5)	**48.4** (8.7)
3. Confidence for learning computers	**3.6** (1.0)	**3.3** (1.2)	**3.1** (1.2)	**3.6** (1.7)	**2.7** (1.1)	**3.1** (1.1)
4. Confidence for using	**4.1** (1.4)	**3.8** (1.7)	**3.4** (1.3)	**4.4** (2.1)	**3.8** (2.5)	**4.1** (2.1)
5. Anxiety for computers	**28.1** (4.8)	**28.5** (5.3)	**30.8** (4.3)	**26.5** (7.4)	**27.3** (7.3)	**27.6** (7.7)

Table 18
Descriptive statistics for teachers' attitude toward computer by those who are currently suing computers and those who are not currently using computers.

Factors measured teachers' attitude toward computers	Using computers M	Using computers SD	Not Using computers M	Not Using computers SD
1. Liking computers	23.2	5.8	28.1	7.9
2. Value for computer in education	49.1	5.4	52.6	4.6
3. Confidence for learning computers	3.2	1.2	3.5	1.6
4. Confidence for using computers	3.8	1.8	4.5	2.1
5. Anxiety for computers	28.4	6.1	26.6	7.5

Table 19
Descriptive statistics for teachers' attitude toward computer by previous experience in operating computers.

Factors measured teachers' attitude toward computers	0 experience M (SD)	Few days M (SD)	1 to 6 months M (SD)	7 month M (SD)	Over a year M (SD)
1. Liking computers	**21.9** (6.4)	**23.2** (7.6)	**24.8** (4.7)	**27.2** (4.0)	**30.7** (5.3)
2. Value for computer in education	**103.0** (6.2)	**102.7** (4.1)	**104.8** (3.0)	**104.7** (3.8)	**105.5** (6.9)
3. Confidence for learning computers	**2.9** (1.0)	**3.5** (1.3)	**3.3** (1.5)	**3.7** (1.7)	**3.9** (1.1)
4. Confidence for using computers	**3.3** (1.5)	**3.9** (1.3)	**4.0** (1.2)	**0.0** (0.0)	**0.0** (0.0)
5. Anxiety for computers	**20.8** (5.8)	**28.2** (3.4)	**28.8** (3.6)	**25.9** (6.1)	**20.7** (7.0)

Descriptive statistics for teachers' attitude toward computer by rate computer skills before school year.

Factors measured teachers' attitude toward computers	None M (SD)	Poor M (SD)	Average M (SD)	Good M (SD)	Excellent M (SD)
1. Liking computers	**19.1** (5.3)	**19.1** (3.9)	**24.1** (5.8)	**26.7** (5.8)	**30.2** (5.8)
2. Value for computer in education	**104.2** (2.8)	**102.2** (6.0)	**103.4** (6.7)	**104.1** (3.6)	**106.2** (6.8)
3. Confidence for learning computers	**2.3** (1.0)	**2.6** (0.7)	**3.3** (1.1)	**3.8** (1.4)	**3.8** (1.3)
4. Confidence for using computers	**2.0** (0.0)	**2.7** (1.2)	**3.7** (1.2)	**5.1** (1.8)	**6.1** (2.3)
5. Anxiety for computers	**34.4** (1.3)	**31.3** (5.1)	**29.2** (4.7)	**24.9** (5.8)	**20.7** (7.4)

Table 21: Descriptive statistics for teachers' attitude toward computer by rate ability to use computer now.

Factors measured teachers' attitude toward computers	None M (SD)	Poor M (SD)	Average M (SD)	Good M (SD)	Excellent M (SD)
1. Liking computers	**17.9** (3.2)	**21.6** (4.6)	**25.7** (5.7)	**30.3** (6.2)	**22.0** (2.8)
2. Value for computer in education	**102.0** (6.6)	**103.5** (4.3)	**104.0** (6.5)	**104.7** (5.2)	**101.5** (3.5)
3. Confidence for learning computers	**2.1** (0.3)	**2.7** (0.8)	**3.6** (1.0)	**4.5** (1.5)	**2.0** (0.0)
4. Confidence for using computers	**2.2** (0.6)	**3.0** (1.1)	**4.3** (1.3)	**6.6** (1.8)	**2.5** (0.7)
5. Anxiety for computers	**32.7** (4.9)	**30.8** (4.3)	**27.0** (4.5)	**19.8** (6.5)	**34.5** (0.7)

Table 22

Multivariate analysis of variance for teacher's attitude toward computers school, usage of computer, previous experience and rate of computer skills.

Multivariate Tests of Significance		Univariate F Ratio: Factors measuring teachers' attitude toward computers				
Source	F	1	2	3	4	5
1. Attitude by school	0.78	1.6	0.52	1.59	0.70	1.24
2. Attitude by usage of computer	0.88*	10.45*	7.93**	0.733	2.27	1.39
3. Attitude by previous computer experience	0.62***	9.4***	0.62	2.9	12.1**	8.3***
4. Attitude by rate computer skills before school year	0.51***	12.6***	1.0	6.5***	19.9***	15.6***
5. Attitude by rate ability to use computer now	0.40***	17.0***	0.69	16.6***	35.3***	22.3***

Note: Analyses are on (1) liking computers, (2) value for computer in education, (3) confidence learning computers, (4) confidence using computer, and (5) anxiety for computers.

1 df= 5, 124 2 df= 1, 1283 df= 1, 125 4 df= 4, 125

* p<.05 **p<01 ***p<.001